Conclusion:

For the foregoing reasons, Applicant submits that claims 11-42 are allowable and respectfully requests favorable action.

Respectfully submitted,

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according to their location we can obtain the fingerprint pattern (image data) of the finger used to press the sensor. (See Application, page 12).

Support for amended claim 12 and new claim 31 can be found in the application on page 6, in Figure 29, and on pages 50-51 wherein an embodiment comprising a portable key unit comprising the sensor, the processor, and the semiconductor memory device are disclosed.

Support for amended claims 13 and 23 can be found in the application on pages 50-51 and in original claims 5 and 10 wherein communication via an electrical connector, wireless communication (i.e., infrared, etc.), magnetic coupling, or electrostatic coupling is disclosed.

Support for amended claims 14 and 24 can be found in the application on pages 50-51 wherein it is disclosed that the portable key unit may be a card.

Support for amended claim 15 can be found in original claims 4 and 9 as well as pages 4-5 of the application wherein it is disclosed that the processor which performs the matching functions is embedded in a logic element which can be either distributed or integrated with the other elements of the invention.

Support for amended claims 16 and 22 can be found in the application on pages 51-52 and Figure 30 wherein it is disclosed that the registration processing functions and the matching processing functions may be separated such that either can be embedded in the portable key unit.

Support for amended claims 17 and 21 can be found on page 51 of the application (with reference to Figure 30) wherein it is disclosed that "[i]f the data receiving side alone stores the registered fingerprint codes and the matching is done by the card K (controller), the registered fingerprint codes can be transmitted from the data receiving side to the data transmitting side."

Support for amended claim 20, new claim 30, and new claim 42 can be found in original claims 4 and 9 as well as the application on pages 51-52 wherein it is disclosed that fingerprint data storage can occur on the portable key unit while the matching is performed off the portable key unit, while the sensor may be located either on or off the portable key unit.

Further support for new claim 30 can be found in original claim 7.

Also, Applicant submits that the objections under 37 CFR 1.75 in the prior Office Action for claims 28-29 being improper dependent claims has been overcome given that those claims have been canceled.

Further, Applicant submits that the section 112 first paragraph rejection of claims 12-18 for reciting that various components are housed in the "locking mechanism" has been overcome because the amended claims no longer contain such a limitation.

Further, Applicant submits that the section 112 second paragraph rejection of claims 13 and 22 from the prior Office Action (claims 13 and 22 now correspond to amended claims 16 and 22) has been overcome because amended claims 16 and 22 now recite a first processor for matching and a second processor for registration.

Moreover, the section 112 second paragraph rejection of claim 19 found in the prior Office Action for ambiguity arising out of the use of "switching device" in the preamble of the claim and "switch" in the body of the claim has been overcome by amending the term "switch" to be "starting switch." Applicant submits that by amending claim 19 such that the "switch" is now the "starting switch", claim 19 has clear definition. Support for the term "starting switch" can be found in the application on page 64 and in Figure 43. Given that both the "switch" of previous claim 19 and the "starting switch" of amended claim 19 refer to the same subject matter, the scope of claim 19 is not narrowed by this amendment.

I. The amended claims are not rendered obvious by the combination of Bowker and Itsumi because the Bowker/Itsumi combination fails to teach or suggest "a pressure-based fingerprint sensor for detecting a fingerprint pattern comprising at least a portion of a plurality of ridges and a plurality of valleys of a finger in both an x-direction and a y-direction when said finger is pressed against said sensor."

Each independent claim recites "a pressure-based fingerprint sensor for detecting a fingerprint pattern comprising at least a portion of a plurality of ridges and a plurality of valleys of a finger in both an x-direction and a y-direction when said finger is pressed against said sensor." However, the Bowker/Itsumi combination fails to teach or suggest such a sensor.

As acknowledged in the prior Office Action, Bowker teaches the use of an optical fingerprint sensor and not a pressure-based fingerprint sensor. As noted by the Applicant on page 2 of the application, optical fingerprint sensors are undesirable in several real world applications (such as outdoors, in dark environments, etc.) because they are prone to error in weak ambient light environments or when moisture is present. In an effort to improve lock and switch-controlling systems using fingerprint detection, Applicant uses pressure-based fingerprint sensors. As such, Applicant's sensor lock "is not susceptible to the effects of moisture ...,

dryness, greasiness of the finger, etc. compared to the optical or capacitance-based sensors." (See Application, page 19). Also, the pressure-based fingerprint sensor "can be used irrespective of the season, geographical location, weather, and other environmental factors", including "outdoor light, radio waves, other electromagnetic waves, etc." (See Application, page 19). Further, the use of a pressure-based fingerprint sensor allows the sensor lock to be "very light, small, short, and thin" as well as consume "very little power" as compared to conventional sensors such as optical sensors. (See Application, page 19).

Given that Bowker teaches the use of an optical fingerprint sensor, a type of sensor Applicant seeks to avoid, Applicant submits that Bowker fails to teach or suggest the use of a pressure-based fingerprint sensor.

Further, the Itsumi reference fails to teach or suggest the use of Applicant's claimed sensor. It must be noted that amended claims 11, 19, and 27 recite that the pressure-based fingerprint sensor has the ability to detect "a fingerprint pattern comprising at least a portion of a plurality of ridges and a plurality of valleys of a finger in both an x-direction and a y-direction" when a finger is pressed against the sensor. With reference to Figure 2(b), which depicts a preferred embodiment of the fingerprint sensor, and its accompanying text on page 12, the pressure-based fingerprint sensor of the present invention detects the ridges and valleys of a fingerprint in both an x-direction and a y-direction (in the preferred embodiment of Figure 2(b), see x-direction resistor 160 and y-direction resistor 170 whose outputs are fed to detector 118). By detecting the ridges and valleys of a fingerprint pattern on an x-y plane, the pressure-based fingerprint sensor of the present invention generates a highly accurate fingerprint pattern that serves as an excellent indicia of authenticity for an authorized person.

However, the Itsumi reference teaches the use of a fingerprint sensor that detects the "projections" and "recesses" of a finger in a single "longitudinal" direction. (See Itsumi, column 7, lines 20-33). Further, Itsumi teaches that such "one-dimensional surface shape data" is desirable over two dimensional data (such as a fingerprint pattern which comprises ridges and valleys in both an x-direction and a y-direction), because the one-dimensional data allows for a "smaller data volume" and a simpler faster matching algorithm. (See Itsumi, column 3, lines 18-41).

Therefore, Itsumi teaches away from doing precisely what Applicant has done. That is, Itsumi teaches that the fingerprint sensor should not detect a fingerprint pattern comprising the

ridges and valleys of a finger on an x-y plane, but rather only on a single plane (merely a fingerprint "shape" - as noted by the title of Itsumi's invention). As such, Applicant submits that the Itsumi reference fails to render the present invention obvious. Proceeding contrary to the wisdom espoused by Itsumi, Applicant's fingerprint sensor detects the ridges and valleys of a finger in both the x-direction and y-direction. Such a two-dimensional fingerprint pattern is not only highly accurate, but also does not impede the size of the sensor, the speed of matching, or the amount of required memory.

Therefore, neither Bowker nor Itsumi teach or suggest the use of "a pressure-based fingerprint sensor for detecting a fingerprint pattern comprising at least a portion of a plurality of ridges and a plurality of valleys of a finger in both an x-direction and a y-direction when said finger is pressed against said sensor."

II. The amended claims are not rendered obvious by the further combination of Bowker and Itsumi with the Gullman reference because Gullman also fails to teach or suggest the use of a pressure-based fingerprint sensor which detects "a fingerprint pattern comprising at least a portion of a plurality of ridges and a plurality of valleys of a finger in both an x-direction and a y-direction."

Gullman is directed toward a "biometric token for authorizing access to a host system." Gullman teaches how a biometric feature (such as a signature, fingerprint, or voiceprint) of a person can be used in conjunction with an encoded token to limit access to various places or objects to authorized persons. (See Gullman, column 2, lines 20-47). As part of this invention, Gullman briefly notes that its biometric security apparatus 14 may include a biometric sensor 18. (See Gullman, Figures 1-3; column 4, line 39 through column 5, line 54; particularly column 5, lines 40-54). Gullman discloses that the biometric sensor "may detect a fingerprint, a signature, a voice or other like information." (See Gullman, column 5, lines 47-49). More specifically, Gullman teaches that a fingerprint sensor embodiment may be a "scanning device" or a "CCD imaging device", while a signature sensor embodiment should be a "pressure sensing device." (See Gullman, column 5, lines 49-53).

As such, Applicant submits that not only does Gullman fail to teach or suggest the use of a fingerprint sensor which detects both the ridges and valleys of a finger on an x-y plane, but also fails to teach or suggest the use of a pressure-based fingerprint sensor. Instead, Gullman teaches

that a scanning device of CCD imaging device should be used. Therefore, the combination of Bowker/Itsumi/Gullman fails to render independent claims 11, 19, 27, and 41 obvious.

Further, while Gullman notes that its biometric security apparatus may be implemented on an integrated circuit card 14 that is portable (See Gullman, Figure 3, column 5, lines 34-39), Gullman contains absolutely no teaching or suggestion to one of ordinary skill in the art how a pressure-based fingerprint sensor can be implemented on such a portable card. Thus, the Bowker/Itsumi/Gullman combination also fails to render claims 13-15, 21-22, 27-29, and 31-32 which require that the portable key unit include Applicant's pressure-based fingerprint sensor.

III. New claims 32-41 are also patentable over the combination of Bowker, Itsumi, and Gullman.

With respect to claims 32 and 36, the Bowker/Itsumi/Gullman combination fails to teach or suggest the use of a plurality of processors and a plurality of semiconductor memory devices to perform fingerprint match determinations in parallel.

With respect to claims 33 and 37, the Bowker/Itsumi/Gullman combination fails to teach or suggest the rejection of a fingerprint pattern that perfectly matches registered fingerprint data.

With respect to claims 34 and 38, the Bowker/Itsumi/Gullman combination fails to teach or suggest the recording of fingerprint patterns which correspond to failed access attempts.

With respect to claims 35 and 39, the Bowker/Itsumi/Gullman combination fails to teach or suggest the use of time as a further limiting factor for when an authorized person is allowed to lock/unlock/start an object.

With respect to claim 41, the Bowker/Itsumi/Gullman combination fails to teach or suggest the use of the fingerprint sensor, memory, and processor to control both the locking/unlocking of a first object and the connection of power to a second object.

MARKED COPY OF AMENDED CLAIMS 11-29

(additions are underlined; deletions are bracketed)

11. (amended) A locking device comprising:

(a) a locking mechanism for locking and unlocking movement of an object [to be unlocked];

[(b) a mechanism or an electronic circuit for restricting unlocking movement of the object;]

(b)[(c)] a pressure-based fingerprint sensor for detecting a fingerprint pattern comprising at least a portion of a plurality of ridges and a plurality of valleys of a finger in both an x-direction and a y-direction when said finger is pressed against said sensor;

(c)[(d)] a semiconductor memory device for storing registered fingerprint data;

(d)[(e)] a processor configured to determine [matching unit for determining] by electronic processing whether the fingerprint data created from the fingerprint pattern detected by said fingerprint sensor matches with any of the registered fingerprint data stored in said semiconductor memory device; and

(e)[(f)] a control unit for controlling whether said locking mechanism locks or unlocks movement of said object in response to said fingerprint match determination by said processor [unlocking the locking mechanism through said restricting mechanism or electronic circuit when there is a match between the detected fingerprint data and the registered fingerprint data;

wherein at least one of said components (b) to (f) is housed in a portable key unit separated from said locking mechanism].

12. (amended) The locking device of claim 11 further comprising a portable key unit separated from said locking mechanism for communicating to said control unit how to control said locking mechanism according to said fingerprint match determination by said processor, said portable key unit comprising said sensor, said processor, and said semiconductor memory device but not said control unit [wherein said pressure-based fingerprint sensor and said semiconductor memory device are housed in said locking mechanism, and wherein said matching unit is housed in said portable key unit].

13. (amended) The locking device of [according to] claim 12 [11] wherein said portable key unit is configured to communicate with said control unit via (1) at least one electrical connector, (2) wireless communication, (3) magnetic coupling, or (4) electrostatic coupling [said pressure-based fingerprint sensor and said matching unit are housed in said locking mechanism, and wherein said matching unit is housed in said portable key unit].

14. (amended) The locking device of claim 12 [11] wherein said portable key unit is a card [wherein said pressure-based fingerprint sensor and said matching unit are housed in said portable key unit, and wherein said semiconductor memory device is housed in said locking mechanism].

15. (amended) The locking device of claim 11 further comprising a portable key unit separated from said locking mechanism, said portable key unit comprising said processor but not any of said components (b), (c), or (e)[wherein said pressure-based fingerprint sensor, said matching unit, and said semiconductor memory device are housed in said portable key unit].

16. (amended) The locking device of claim 11, wherein said processor is a first processor, wherein said locking device further comprises a second processor in communication with said first processor and said semiconductor memory device, said second processor being configured to register an authorized person by storing in said semiconductor memory device fingerprint data created from said fingerprint pattern of said authorized person and detected by said sensor, and wherein said locking device further comprises a portable key unit separated from said locking mechanism, said portable key unit comprising either (i) said first processor and said sensor but not said second processor, or (ii) said second processor and said sensor but not said first processor [said locking mechanism and said portable key unit are connected either electrically through a connector, by wireless, through an infrared beam, by magnetic coupling, or electrostatically].

17. (amended) The locking device of claim 11 further comprising a portable key unit separated from said locking mechanism, said portable key unit comprising said sensor and said processor but not any of said components (c) or (e) [wherein said portable key unit is a card].

memory ← controller

18. CANCELED

19. (amended) A switching device comprising:

(a) a starting switch for starting operation of an object;

(b) a pressure-based fingerprint sensor for detecting a fingerprint pattern comprising at least a portion of a plurality of ridges and a plurality of valleys of a finger in both an x-direction and a y-direction when said finger is pressed against said sensor;

(c) a semiconductor memory device for storing registered fingerprint data; and

(d) a processor configured to (1) determine [matching unit for determining] by electronic processing whether the fingerprint data created from the fingerprint pattern detected by said sensor matched with any of the registered fingerprint data stored in said semiconductor memory device and (2) actuate said starting switch in response to said fingerprint match determination being positive[;]

[(e) a control unit for operating said starting switch when there is a match between the detected fingerprint data and the registered fingerprint data;

wherein said pressure-based fingerprint sensor or said semiconductor memory device is housed in a portable key unit, and wherein said pressure-based fingerprint sensor is separated from said switch].

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20. (amended) The switching device of claim 19 further comprising a portable key unit separated from said starting switch, said portable key unit comprising said semiconductor memory device but not said sensor or said processor [wherein said pressure-based fingerprint sensor and said matching unit are housed in said switch, and wherein said semiconductor memory device is housed in said portable key unit].

21. (amended) The switching device of claim 19 further comprising a portable key unit separated from said starting switch, said portable key unit comprising said sensor and said

processor but not said semiconductor memory device [wherein said pressure-based fingerprint sensor and said matching unit are housed in said portable key unit, and wherein said semiconductor memory device is housed in said switch].

22. (amended) The switching device of claim 19 wherein said processor is a first processor, wherein said switching device further comprises a second processor in communication with said first processor and said semiconductor memory device, said second processor being configured to register an authorized person by storing in said semiconductor memory device fingerprint data created from said fingerprint pattern of said authorized person and detected by said sensor, and wherein said switching device further comprises a portable key unit separated from said starting switch, said portable key unit comprising either (i) said first processor and said sensor but not said second processor, or (ii) said second processor and said sensor but not said first processor [said pressure-based fingerprint sensor and said matching unit are housed in said portable key unit, and wherein said matching unit is housed in said switch].

23. (amended) The switching device of claim 31 [19] wherein said portable key unit is configured to communicate with said starting switch via (1) at least one electrical connector, (2) wireless communication, (3) magnetic coupling, or (4) electrostatic coupling [said switch and said portable key unit are connected either electrically through a connector, by wireless, through an infrared beam, by magnetic coupling, or electrostatically].

24. (amended) The switching device of claim 31 [22] wherein said portable key unit is a card.

25. CANCELED

26. CANCELED

27. CANCELED

28. CANCELED

29. CANCELED